CHAPTER 8

Research role in defining customer needs on innovative projects

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1. Background

The development of innovative products has long been driven by technological advances. Scientific progress achieved by research centres has fostered the planning of new products and brought about significant improvements in existing ones. New product development has thus been guided by research, with the focus on new fields which reflect acquired expertise, new findings reported in the literature, and topics studied by academic research teams. This "technology-push" strategy has undeniably made it possible to market many innovative products, as is shown by the technological progress accomplished since the turn of the century. Some developments, however, have not achieved the expected market success, and these setbacks have been attributed to flawed knowledge of the market.

In the mid-1970s, two corporate trends became apparent, the first of which was the rise in the power of marketing. As marketing skills grew, internal market analysis and responsiveness to customer expectations and segmentation grew accordingly, and centres of expertise were restructured into divisions or departments. Marketing experts, initially called upon to support product sales, were subsequently asked to define target-products for development. The second such trend was the rationalization of research operations, aimed at imposing budget limitations, often determined by a percentage of "normal" revenues for the industrial sector involved. The question then arose as to how projects should be prioritized in

terms of their inherent advantages and disadvantages, and the urgency of demand for them. The by-word for the past fifteen years for research management has thus been "market-pull". The customer makes purchasing decisions, which means the customer is king, and his or her needs must therefore be understood. Understanding customer needs became therefore the task of marketing experts, and the point of departure for establishing research programs and formulating goals and priorities. This was a total reversal of the process and rationale on which new research projects had previously been based.

With ten years' experience behind us, we can now assess this new model in terms of both its positive and its negative aspects. On the positive side, it has clearly fostered a learning process, strengthening the customer rationale for product development. It has proved to be broadly applicable and effective for innovations of an incremental type, and for industries operating in proximity to the final market. On the negative side, in today's innovation-based competition between corporations, adaptive innovations, although necessary, are no longer enough to ensure a strong position in a given market (Tushman & Andersen 1986, Cohendet and Llerena 1990, D'Aveni 1994, Lynn, Morone & Paulson 1996, Chakhravarthy 1997). In addition, to satisfy new customer needs and develop the innovations they need, corporations which manufacture mass-market products are increasingly turning to sourcing sectors (Iansiti & Clark, 1994, Kesseler 1998). Finally, product-targeting errors cannot be corrected, as competitors do not give innovators a second chance. They learn rapidly from the failures of others, and are quick to offer new products of their own.

The punctuated equilibrium (Romanelli & Tushmann 1994) which alternates long periods of incremental innovation and breakthrough related to radical innovations does not seem to be appropriate to describe today's race between firms. Recent works focus on a new model of organization favouring continuous change which means the development of important innovations at a sustained rythm (Utterback 1994, Dougherty & Hardy, 1996, Brown & Eisenhardt 1997).Their focus is to characterize these kinds of organization as a whole, and they

insist for example, on project portfolios and how to articulate today's developments and competencies with future innovations. Our contribution belongs to this research stream. This process has also been studied for radical innovations in Science Sociology (Ackrich, Callon Latour 1988). They pinpoint the role of various actors surrounding the innovation and the importance of their involvement in the success. What are the implications within a firm of such theoretical results ? I focus on the process of product targeting and the early stages of design. I elaborate on the notion of the low cost probe mentioned by Brown & Eisenhardt 1997 and the probe and learn process of Lynn Morone and Paulson 1996, in defining the role and competencies of research and marketing and the way they coordinate in those very uncertain situations.

What would the ideal development-design model for breakthrough innovations be, especially at the level of industrial sourcing? This is the broad question I have attempted to give some answers to based on research conducted at a major French chemicals corporation, for which this question is particularly relevant. This is because the specialized chemicals industry is subject to a product-differentiation strategy and most of its products are sold to processors. Finally, product-innovation and product-function innovations raise fundamental research questions. The ability to transform technical innovations into marketable products is therefore of key importance.

In the first section, I describe the limitations of the "market-pull" model, the impact of which is particularly strong because it focuses on innovations in basic materials processed by intermediate manufacturers before reaching the end-user. In the second section, I formulate a design-model which takes these limitations into account, pinpointing one specific aspect: the coordinating mechanisms which facilitate the simultaneous acquisition of expertise concerning customer needs and markets, as well as product accessibility. In conclusion, I have touched on other aspects of the model which require clarification, so that this coordination can be implemented effectively: the internal organization of expertise; contracts and

incentives for the various players; and the involvement of customers or partners.

2. The limitation of the "market pull" model

First of all, I present a brief review of several defining elements in the market-pull model before going on to list the main problems involved in its implementation.

The market-pull model assumes an initial definition of the products, services, or functions to be developed; they are defined on the basis of an analysis of markets, customers, and customer needs and preferences. This model thus assumes the presence of a player with the appropriate expertise: the marketing expert. Marketing experts are expected to formulate the product-target before the initiation of the research operation required to fulfill it. The relationship between marketing and research is "contractual" in nature. Respective responsibilities are clearly delineated in a manner resembling the property-developer/contractor relationship which is characteristic of project-management models, particularly in the construction field. Lastly, the respective players in this relationship mobilize bodies of disparate expertise. Although in practice the implementation of this model does not always involve roles as contrasted and "compartmentalized" as this, a critique of the ìideal-model" appeared to us to offer greater scope for analysis.

Marketing-expert techniques and expertise

However, first let us return to the marketing experts, who are expected to use their analytic techniques to formulate specifications for the customers' dream product. The basic techniques used are market analysis and product positioning.

During the early project phases, knowledge about the product is minimal. Will this additive for paint be totally biodegradable? Solvent-free? Here, as in any development process, there are imponderables. How can traditional focus-group and survey techniques be used when no product-samples are available to quantify preferences and spot threshold effects? This is the first problem encountered when the marketing approach is used during the early project phases. It requires the

development of new investigative methods, on the basis of which expertise regarding preference can be effectively built.

The second problem is that knowledge about the market is also minimal. Depending on the future properties of the product, it may or may not be useful for certain applications (as an additive for "do-it-yourself" varnishes, for instance; or, conversely, for industrial paint). Here again, market segmentation will be difficult as long as uncertainties concerning the product persist.

The third problem is to extrapolate over one, two, or several years. Let us assume that precise product and product-market profiles have been defined; the market survey then generates a sales forecast based on an analysis of today' products. By the time they will be introduced onto the market, many factors will all have been subject to change. Meanwhile, other innovations will have been introduced; new standards may have been established; the market may have been fragmented by these other innovations, etc.

Making use of marketing techniques without additional precautions and adjustments is thus particularly risky. J. M. Gaillard (1997) even goes so far as to claim that if the goal is to kill an innovation, there is no better way to do so than to conduct a market survey. He suggests doing the opposite: i.e. constructing a methodology specifically suited to these highly uncertain early phases. He bases his argument on many personal interviews and on the meticulous examination of a qualitative analysis drawn from the findings. I shall return to these findings in the second section.

Customer expertise

A second category of problems has to do with customers and their own expertise.

Breakthrough innovations are only rarely identified by asking even enlightened customers about their potential needs. Who would ever have imagined buying a glue that doesn't stay glued? And yet, this is the very property that everyone appreciates today. It was up to 3M (or, more modestly, to a researcher) to invent a possible use by consumers. Here, the issue is to invent (or crystallize) diffuse, latent, implicit needs

that could be satisfied; and to construct, in cooperation with customers (by integrating them into the validation loop) a usage-value drawn from the opinions they express. This is not merely a matter of "harvesting" existing information which needs only to be tabulated.

The problems do not differ significantly even when the product under development is similar to existing products. The views of some customers will be of no use whatsoever if the product is not ready to be handled and tested. In the case of a varnish-development project, for example, the product's drying-time following application did not emerge as a crucial parameter until very late. The craftsmen at whom this product was being targeted simply assumed they would be able to apply a second coat the day after applying the first one, and did not bother mentioning this criterion. This demonstrates the vulnerability of evaluations made before the product has been tested. Some customers, on the other hand, will formulate extremely rigid technical specifications. Chemicals-industry customers, from detergent manufacturers to auto-makers, tend to present highly detailed specifications. In instances such as this, specifications based on customer expertise can also act as a brake on innovation, not because the criteria have not been thoroughly identified at the inception of the project, but because the desired objective involves too many demands. Specifications of this kind are frequently based on a technical solution to be improved. For example, when an auto-maker presents dashboard specifications independently to a plastics supplier, there is a good chance that the resulting component will be too heavy and too costly. To produce a lighter, less costly component, several points in the specifications need to be changed, and defining the margin for maneuver within which profits can be earned by both parties assumes a continuous mutual-learning process. As a consequence we can observe the formation of design partnerships

In general, customers' expertise about their own potential needs and preferences is patchy. Some customers make assumptions which they have difficulty expressing. The formulation of purchasing specifications fills in some of the

gaps, but can place limitations on innovation. Meanwhile, other gaps will appear. Customers will only be able to perceive the value of an unfamiliar property, or pinpoint their preferences, by evaluating the product. It is therefore advantageous to create a market expertise which customers do not necessarily possess. It is even reasonable to claim that this type of expertise yields a competitive advantage.

Customer-system complexity

A third problem category encountered in the market analysis of products under development is the diversity of relevant opinion-sources.

For example, which opinion source should be given priority when the customer is a corporation (as is often the case in the chemicals industry)? The Purchasing Department, the R&D Department, the project teams, or the strategists? This question is particularly important, as the issue here is not to market a product, but to anticipate what will satisfy customers several months or even years ahead.

Customer-contacts can be made internally by various players: sales personnel, researchers (through technical assistance), and plant workers (through complaints). How can these various ways of approaching the customer be combined?

Furthermore, a direct customer is not necessarily in the best position to evaluate usage-relevance for the end-consumer, as there may be several intermediate stages between them. Consultants may also play a decisive role. While a direct customer might consider a specific function to be superfluous, the customer's own client might consider it crucial. A good example is a product designed to eradicate salmonella at poultry slaughterhouses. The direct customer (the slaughterhouse) might show little interest in a substance that would increase costs of a product (poultry) for which the profit margin is already very low. However, the final consumer (the purchaser of poultry in a supermarket) might be willing to pay a premium for added product-safety. If innovations are to be successful, these different rationales must be taken into consideration.

Furthermore, strategic considerations are integral to the relationships among intermediaries in a given industry. The

introduction of an innovation provides an opportunity to redefine the profit margins and prerogatives of each intermediary. In the auto industry, the situation is relatively stable, but this is not the case for all industries, and particularly chemicals. The structure of the chemicals industry is complex: a customer for one type of product might be a supplier of another type, and a competitor for yet a third. To a complexity which reflects the large number of players involved is added a strategic complexity which is increasing due to current trends towards developing alliances, joint ventures, and licensing agreements.

This means that the market-testing of innovations may have an undesired repercussion: the triggering of competition.

Then again, customer interest (or lack of it) in an innovation may reflect rationales only remotely connected with the technical evaluation of the proposed product. For example, a customer might give serious attention to innovations offered by various suppliers, not because it is looking around for a new supplier, but simply because it wants to shake up its old ones. Alternatively, a customer might indicate lack of interest in a new product solely to discourage its development by a competitor of one of its own corporation's divisions, which is trailing the field. Customers might also be reluctant to show interest in an innovation due to the testing expenses involved, and to the risk that a new product still experiencing teething problems might negatively affect their brand image while at the same time providing no guarantee of long-term market penetration.

When the multiplicity of opinion sources represented by the customer-system is taken into account, the question arises of how divergent viewpoints should be analysed and rated.

The demand dynamic

The current competitive context is characterized by market versatility, rapid introduction of product/process innovations, and accelerated change in the regulations governing environmental protection (Cohendet Llerena 1990). All of this takes place in a price-war climate. Thus stability of demand is an extremely strong assumption, rarely verified,. Examples

abound of market-demand instability and the speed with which market demand shifts relative to product-development time-frames. The impact of this problem is accentuated by the fact that product/process and expertise development require a longer time-frame than that allowed by the pace of change in the market and the competitive environment.

The various limitations described above have an even greater impact on lengthy development projects (lasting several years), and breakthrough innovations usually fall within this category. Problems arise in connection with anticipating shifts in the market; with the difference between the product-functions being developed and those customers are familiar with; with the time required before a testable product can be introduced, etc. When the innovation being developed targets industrial suppliers, the difficulty in anticipating market demands increases in proportion to the strategic complexity of the industry and the interrelationships among its various players.

What kind of model can account for all these market characteristics, and for the problems involved in the market analysis of breakthrough-innovation development?

3. Towards an integrated product/market model design

Demand instability, the inability of traditional marketing techniques to identify unexpressed needs, and the strategic complexity associated with multiple players all point to the desirability of placing the process of target-market construction in a time-frame that parallels that of the technical product-design process. In this way, the product's technical feasibility, its user's needs, and the price the latter is willing to pay can be explored in a parallel, rather than sequential fashion. Two learning processes occur; two bodies of expertise are constructed on the basis of two interdependent "objects." This is the guiding principle underlying the integrated-model design, and it is borne out by other theoretical work.

For example, research which analysed innovation processes, conducted at the Centre de Sociologie de l'Innovation M.

Ackrich, M. Callon, and B. Latour (1988) criticizes the "linear" model which postulates a sequence from basic research to the market, successively passing through applied research, product development, and production. This work underscores the importance of achieving the involvement of the various players throughout the innovation process: future users, financiers, consultants, and production-process developers. The authors stress the importance of negotiating the technical objective with all the parties involved.

Theoretical work by Simon (1969) demonstrates that the definition of the problem cannot be divorced from the formulation of the solution. Design is a dual process which results from the combined definition of the problem and the solution. Research by C. Midler (1993) on project management has highlighted the time and cost advantages accruing from simultaneous consideration of the project's target and its technical solution (product/process).

The evolution in project management for the case studied demonstrates the emergence of this design construct, which focusses on both the relevant target and the potential products.

However, in the "market-pull" model, marketing/research coordination follows a linear sequence; and, in fact, this is also the case for the "technology-push" model. The output of the former becomes the operational input of the latter. The only difference between them is the order in which the departments intervene, and their hierarchical position in relation to each other: the one which establishes the constraints is considered to be the one in the dominant position. Coordination is greatly simplified by another point: concentration of the market interface on a single player, the marketing expert. Information thus travels in a linear manner between the firm's various departments: the players involved with internal production have as their (internal) customer a profit-centre marketing expert who oversees the interface with the post-production customer, represented by a purchasing function which, in turn, communicates with production/development functions, and so on, all the way to the final consumer. According to this rationale, marketing-department expertise is oriented primarily

towards familiarity with customers, commercial negotiations with them, and prices.

Under the new model being proposed, what are the coordination modalities which will enable researchers to do their work despite the fact that no one has asked them any questions; and what will enable those in the process of formulating the questions (the market experts) to trust that their colleagues are working on solutions to a problem they have not yet fully defined?

As the process advances, coordination objectives and modalities will be specified which facilitate the parallel and symmetrical deployment of both the research and the market explorations.

A common point of departure for parallel explorations

The point of departure for an innovation project is a pathway to be explored: a silicon mastic for tools so they can be cleansed with water for example. Initial formulation of the objective is common to both the research and the marketing players, and serves as the launch-pad for parallel exploration.

The researchers will posit various technical solutions. Experiments which prove technically unfeasible are easily eliminated. Often, however, initial findings are not decisive. One approach will present certain advantages, another approach different ones. Choosing which one to concentrate on cannot be done by the researchers alone; an evaluation must also be made by the marketing experts.

In parallel, market analysis and technical exploration go forward together. The market analysis builds an initial assessment of the project's potential advantages and disadvantages. It draws in a highly traditional way on a collection of sales-volume data for the type of product with which the new development will be positioned, and for various existing products and their prices. When marketing experts are expected not only to provide volume and price forecasts, but also to supply a detailed definition of the target market; to orient development on the basis of initial research findings, and to establish compromises between functionalities, they must be able to establish a basis for providing answers to a number of

diverse questions: What causes customers to prefer one product over another? Does the product under development meet all customer demands? Is it highly effective for one category sub-type but less so for another?, etc.

The above criteria assume that marketing experts will be able to embark rapidly on a broader analysis than usual: a comprehensive identification of all customer-system players, including the customer's own customers, the consultants, and the other customers of varying types (not just the largest ones); and the formulation of a methodology designed to provide an understanding of usages and preferences. Depending on the age of the operation for which the new application is intended, this knowledge may already exist; or, inversely, the market may be totally unexplored. The speed with which the project will meet the relevant target is often directly contingent on this factor.

Formulation of testing strategy: a mean of coordination

There are two goals at this stage: first, to extend knowledge of the market; and, second, to pinpoint the research effort. Considering the difficulty customers have in explaining their needs, one strategy consists in facilitating the expression of tacit needs by offering different products and collecting data concerning customer reactions to them. Marketing/research coordination operates through the adoption of a testing strategy which of course will be constructed in a linear manner. It assumes that agreement can be achieved on questions such as: Why test 2 or 3 products? What information do we expect to gain? How do we select customers for product testing? What are the major imponderables, the main factors which might cast doubt on the products?

The researchers' task is generated by the explorations carried out during the first stage, and therefore consists in identifying the different "prototypes" which will enhance understanding of the product diversity to which they might lead. The first consequence for research departments working under this integrated approach is that they must deliver prototypes quickly, organizing a research program enabling them to do so. The second consequence has to do with selection of the products to be supplied. The objective is to acquire a maximum amount of

information in order to orient or re-orient the research program; and this, in turn, means a strategy of broad-based exploration. This approach is very different from the one aimed at finding as quickly as possible a product consistent with specifications fixed at the project's inception, and then conducting feasibility tests for the most promising candidate.

The marketing experts' task is to identify the firms which might be contacted for product-evaluation, and the markets in which they might be representative. Marketing experts also select the players to be involved: direct customers, customers of customers, consultants, etc. For one of the projects studied (for example), it proved possible to use the same technical concept for the development of water-based matte paint, wood varnishes, and industrial paints. For these respective applications, potential-customer lists were drawn up, and the partnership agreement covering concept evaluation was focussed in each instance on a highly specialized segment of the market.

From this stage onwards, the importance of developing the marketing and research approaches in tandem is obvious. To acquire increased knowledge of the market, it is necessary to be in a position to offer test samples in order to plan partnerships; to have access to comparative evaluations of the product relative to the competition; and to learn what the customer criteria are.

Customer evaluations: an opportunity to diversify market interfaces

Data culled from customer evaluations are an important source of information, also providing an opportunity to diversify contacts with customers. The outstanding feature of the relationship with a customer who has evaluated a sample is that much can be learned from it, but no one knows exactly what. To be sure, some questions can be raised at the outset. However, a major advantage of this type of interaction is the opportunity it provides for pinpointing important factors of which the project team may have been unaware. A risk that comes to light is far less "serious" than one that remains in the dark.

Players involved in different departments of a given firm are not always equal in their ability to recognize key points which have been omitted from the development process. Marketing experts, exercising fairly broad judgment, will be particularly sensitive to project evaluations bearing on sales volume and price. Researchers will be sensitive to evaluations bearing on technical points: for example, criteria fixed by them which turn out to be of minor importance; or criteria originally deemed of minor importance which turn out to be major. All the researchers interviewed who had had direct contacts with customers used the opportunity to fine-tune their objectives for the product under development. "When I heard the comments and questions raised by the test for evaluating biodegradability, I realized there were technical problems which needed to be investigated, and that the problem was not just a negotiating one, as had been assumed by the project's marketing supervisor." "In the beginning we were trying to make a paint with no solvent. However, it turned out this wasn't a key criterion for the customer. The product's benefits were assessed on the basis of another criterion altogether." Considering the exposure to potential information loss when a single intermediary from a single field -marketing, for example- is used, this demonstrates the importance of keeping the door open to contacts between customers and a broad spectrum of project designers.

An integrated product/market model design is one in which marketing experts no longer serve as the sole intermediaries for controlling the market interface. However, they are responsible for conducting the market-analysis process, and thus for training project players in methodology. They can explicate tacit areas of expertise and the hypotheses underlying their choices and expectations, and fine-tune project criteria. It is clear that implementation of the integrated product/market model will involve elaborating new types of marketing expertise. Researchers, for their part, must become involved in customer interaction -a situation with which they are not necessarily familiar and must attempt to gather a maximum of information for subsequent stages in the development process. One critical point has to do with problems of confidentiality, which are particularly acute in the case of complex and relatively unstable industries; or of firms that are customers for a product but suppliers through another branch of their operations; or of firms which might also be competitors, through holding-companies or subsidiaries. It is risky to foster contacts between a customer and a researcher possessing the kind of scientific, technical, or economic information a practiced interviewer might seek to acquire. This is why careful preparation of direct customer contacts is needed.

The construction of internal expertise on usage properties

Although direct contacts provide a wealth of information, they are no substitute for more carefully-calibrated demand evaluations. This is because they are extremely time-consuming -a problem for researchers who need to stay in their laboratory and focus on their experimentation to keep projects moving along. Further, customers are reluctant to make large numbers of evaluations for products under development with no guarantee that they will ever be marketed. Customers may be very interested in the benefits promised by a new product, and still consider that they have no reason to participate in its development.

"Prototypes," which are crucial milestones in the development process, will therefore be small in number. This is

why it is important to identify customer criteria at the earliest possible phase in the process; to do so selectively for compromises that are difficult to establish definitively; and to arrange for taking a number of "soundings" during the life of the project in order to ensure that its foundations do not prove totally flawed in the light of subsequent developments.

The way to accomplish the above is to acquire internal evaluation techniques reflecting customer criteria. The task of the "application" research laboratories is to formulate repeatable tests for measuring product usage. The task of the researchers is to acquire a body of expertise. The fit between "application" research laboratory evaluations and customer perceptions is of course crucial. Here again, the importance of coordination between research and marketing for selecting definitive product criteria and standardized measurements becomes apparent. In addition, considering the volatility of customer preference, it is also necessary to conduct regular assessments of the tests formulated internally in relation to direct customer evaluations.

The acquisition of new research expertise

The exploration of technical solutions for improving a product feature, or for selecting products which must present very different properties for users, infers a body of scientific expertise which can link a property of measured application with physical/chemical properties. This is known as "applicability". Here again, the implementation of an integrated product/market model design system fosters the acquisition of expertise which will accelerate the process. At the firm studied, several applicability laboratories were established.

Deploying a parallel research/marketing exploration thus clarifies the contribution of both fields to the definition of the product target, while strengthening the specific expertise developed by each respective field in order to contribute to the process. I have also shown that this type of model has significant implications for both researchers and marketing experts: participation in new situations (at the customers' for researchers; orientation of the on-going research process for marketing experts); different types of intermediary production (prototypes, sampling strategy); the acquisition of new expertise

(bearing on anticipation and partnership for marketing experts; with applications and applicability for researchers); and more frequent interaction between different departments, requiring the construction of intersubjectivity between protagonists.

Some consequences of the implementation of an integrated model

Beyond the emergence of coordination modalities facilitating simultaneous and convergent explorations, the implementation of this type of model raises other questions deserving of mention.

The first question has to do with project-portfolio management. If there is no business plan at the inception of the project, on what basis can the decision to launch a new project be made? How should a project be ranked in relation to other developments? Does the existence of much more reliable market forecasts for more advanced projects, or for projects reflecting a rationale of incremental innovation, threaten to stand in the way of breakthrough innovations? One strategy consists of managing breakthrough-innovation and long-term projects separately. But the prioritization of projects in this category remains a persistent problem: the development of a broad-based exploration strategy depends on the capacity to terminate fairly rapidly projects which do not generate conclusive findings during the early stages, and to transfer the teams to other projects.

The second question has to do with departmental organization. The proposed model infers the continuation of players dealing with the theme being explored and of those in contacts opened with customers. At the same time, it emphasizes the emergence and development of new expertise. How can these two rationales - specialization and project-dedicated players - be articulated? This point infers an internal organization by specialty facilitating the mobilization of a fragmented collective competence. It assumes the formulation of a profile defining players possessing the skills needed to do this, and of facilities supporting them within this dynamic.

A third question has to do with individual motivation. The linear "market-pull" model clearly establishes responsibilities

facilitating the attribution of success or failure to specific players, and the corresponding remuneration. In the proposed model, this kind of responsibility attribution is not possible; but individual interest could be developed around the realization of a shared objective. Ultimately, individual commitment and internal contract could be based on the schedule enabling marketing experts to define, in stages, a precise product target, a market share, and a price. Meanwhile, the research team would base its contract and responsibilities on the strategy of exploration and of the intermediary stages at which testable "products" would be delivered to the marketing-expert partners.

A fourth question has to do with the implication of customers. Partnership strategies have repeatedly been evoked as a way to implicate customers in the design process. The development of this type of cooperation is not spontaneous, and it raises questions as to what share of the final marketable product's value-added will be attributed to each of the various intermediaries involved in its development.

In this chapter, some limitations of the market pull model are underlined especially for innovation. The main weakness of such a model for developing innovative products is the continuous evolution of customer demand and the complexity of the customer system preferences. An alternative model is elaborated where the exploration of the market and the exploration of the technical possibilities for product are two parallel and interconnected processes.

Different conditions to implement such a model are developed.

A continuous coordination between marketing experts and the research team has to be structured, as the specifications of the target product remain partial and moving until late in the project. It is based on the definition of testing strategy combining sets of prototypes and sets of customer types and items to be evaluated.

This coordination mean has implications on the activity of the marketing experts. They have to conduct the market analysis not anymore sole in contact with clients. But they have also to structure the data collected by researcher as well. The

researchers' activity differs also from what it used to be. They have to propose prototypes in order to define what can be done and what product the customer would prefer and not only to find the product that fits perfectly with the specifications previously defined.

Finally, new knowledge has to be developed to speed up this targeting process: in research departments, scientific expertise linking functional properties of the product with chemical of physical properties of the product or of the process.

These seem to be key points to consider in implementing the integrated product/market model design and overcome the limitation of the market pull model for innovative product development.